

## 7.8 WATER RESOURCES

### 7.8.1 Affected Environment

#### ***Climate***

Average annual rainfall within KTA and KLOA ranges from 40 to 50 inches (102 to 127 centimeters) near the coast to 150 inches (381 centimeters) at the summit of the Koʻolau Mountains. Prevailing winds in summer are northeasterly trade winds; in the winter, light south to southwesterly winds prevail, but on some unprotected coastal slopes, average wind speeds of 18 to 20 knots have been recorded (USARHAW and 25th ID[L] 2001a).

Annual evaporation rates vary from about 80 inches (203 centimeters) near the coast to about 20 inches (51 centimeters) on the mountain ridges (Oki 1998).

Drum Road runs along the west slope of the Koʻolau Mountain Range and across the Schofield Plateau, from KLOA, through KTA to SBMR. The road lies within an elevation range of about 1,000 to 1,200 feet (305 to 365 meters) msl, except in the segment between Helemanō Stream and SBMR, where the trail descends to below 900 feet (274 meters) msl. Along most of its route, the average annual rainfall is above 70 inches (178 centimeters). In the last segment, where the trail descends to SBMR, the average rainfall decreases with elevation to about 50 inches (127 centimeters) per year. Annual evaporation exceeds rainfall in this last segment.

#### ***Surface Water***

##### *Surface Water Drainage in Kuhuku Training Area*

Figure 7-12 shows surface water features and watershed boundaries on KTA, which straddles the northern Koʻolau Mountain Range and contains portions of four watersheds. On the west side of KTA is the Paumalū watershed. The Paumalū watershed includes drainages from Paumalū Stream on the west to Waialeʻe Gulch on the east. The headwaters of the Paumalū Stream are in the Pūpūkea Paumalū Forest Reserve, most of which is within the boundaries of KTA. KTA does not include the downstream portion of the Paumalū Stream, but most of the watershed east of the Paumalū drainage, almost to the Kamehameha Highway, is on KTA.

To the east of Paumalū watershed and wedged between it and the ʻŌʻio watershed farther to the east is the Kawela watershed, which includes the streams that drain to Kawela Bay—Pahipahiʻālua Stream and Kawela Stream.

East of Paumalū and Kawela watersheds is the ʻŌʻio watershed, which includes the upper portions of drainages from ʻŌʻio Gulch east to Keaʻālu Gulch, which discharges at the town of Kahuku.

Adjacent to the ʻŌʻio watershed is the Mālaekahana watershed, which consists of the upper drainage of Mālaekahana Stream.

**Figure 7-12**  
Watershed Boundaries and Drainage Features on Kahuku Training Area

The lower reaches of many of these streams have been diverted or captured for irrigation and flood control, but the upper reaches, on KTA, are generally the natural drainages. All streams and gulches on KTA are intermittent, except for Mālaekahana Stream which is perennial (USARHAW and 25th ID[L] 2001a).

#### Surface Water Drainage in the Kawaihoa Taining Area

The ROI for KLOA is the same as the ROI for Drum Road (discussed below), because with the exception of traffic on Drum Road and for purposes of the impact assessment for water resources, training activities within KLOA would not differ from training activities under No Action. Therefore, the discussion of KLOA is included in the discussion of Drum Road. The portion of Drum Road that lies within or adjacent to KLOA is shown on Figure 7-12, and includes the western boundary of the northern half of KLOA.

#### Surface Water Drainage on the Drum Road Route

Figure 7-13 shows the alignment of Drum Road. Helemanō Trail, which extends from the Helemanō Military Reservation to Schofield Barracks, is discussed in Section 5.8. South of KTA, Drum Road passes along the western perimeter of the KTA. First, it crosses the Waimea watershed, which is drained by several streams, including Kauwalu Gulch, ‘Elehāhā Stream, Kamananui Stream, and Kaiwiko‘ele Stream. (Kauwalu Gulch and ‘Elehāhā Stream are both intermittent, while Kamananui and Kaiwiko‘ele Streams are both perennial [flow year-round].) ‘Elehāhā Stream and Kamananui Stream are tributaries of the Waimea River.

The trail passes along the ridge that forms the boundary between the head of the Keamanea, Waimea, and Kawaihoa watersheds, northwest of Pu‘u Kapu. At about this point, the trail follows the Pūpūkea Road and crosses inside KLOA. Here, west of Pu‘u Kapu, it crosses the tiny Kawaihoa watershed and then follows the ridge separating the Kawainui and Kawai‘iki watersheds (on the east) from the Anahulu watershed (to the west). The Kawaihoa watershed is a narrow east-west trending strip of land, north of Pu‘u Kapu, that does not have any surface outflow but probably drains below the surface to the adjacent watersheds. The Kawainui and Kawai‘iki streams (both perennial streams) are tributaries of the Anahulu River, which occupies the Kawaihoa Gulch and discharges at Waialua Bay, north of Hale‘iwa. The junction of the two streams marks the head of the Anahulu watershed. The intake of the Kamananui Ditch and Tunnel, which was designed to divert water from the Kawainui Stream for irrigation in the Keamanea watershed, is at the downstream end of the Kawainui watershed.

The trail emerges from KLOA just east of ‘Ōpae‘ula Reservoir, where it becomes a paved road. The road follows the boundary of the Kawai‘iki watershed, then turns sharply west and continues along the ridge separating the Anahulu watershed and the ‘Ōpae‘ula watershed. The ‘Ōpae‘ula Reservoir is in the Anahulu watershed but is recharged by diversions from the Kawai‘iki and ‘Ōpae‘ula streams, via ditches or tunnels that cross the watershed boundaries.

Southwest of the ‘Ōpae‘ula Reservoir, Drum Road crosses the ‘Ōpae‘ula watershed and the ‘Ōpae‘ula Stream (a perennial stream) and then follows Twin Bridge Road, west of Bryans Mountain House. This segment of the trail is on the boundary between the ‘Ōpae‘ula watershed and the Helemanō watershed.

**Figure 7-13**

Watershed Boundaries and Drainage Features on Drum Road

### Surface Water Quality

None of the watersheds on KTA have been identified as Category I watersheds in need of restoration. The watersheds crossed by Drum Road south of the Kawaihoa watershed are identified by the state of Hawai'i as tier 2 Category 1 watersheds (HDOH 1998b).

Soil erosion has been identified as a potential problem in many areas of the Ko'olau Mountains. Among the major causes of soil erosion, as identified in the Ko'olau Mountains Watershed Partnership (KMWP) Management Plan (Sumiye 2002), are human activities, wildfire, and soil disturbance by pigs. Human activities with the potential to cause erosion, in addition to military training, include hiking, motor biking, and illicit drug cultivation. The KMWP plan notes that these activities have not been identified as severe threats to watershed resources but that the watershed may be affected by these activities in the future as intensity of human use increases.

### **Groundwater**

#### Groundwater Flow

KTA overlies the ridge of the Ko'olau Mountain Range, which is considered to be a hydrologic boundary between the north and windward hydrologic sectors. The western side of KTA is in the Kawaihoa aquifer system of the north hydrologic sector. The Kawaihoa aquifer system is west of the Summit Trail and Kaunala Ridge and is the northward extension of the ridge to the west side of Kawela Bay. The Kawaihoa aquifer system is within the central O'ahu groundwater flow system (Oki 1998). Groundwater in the Kawaihoa aquifer system is thought to drain northwest toward the Waimea coast.

Since 1927, annual groundwater pumping from the Kawaihoa aquifer system reportedly remained below 9 MGD and ranged from 1.5 MGD in 1936 to 8.9 MGD in 1970. The State of Hawai'i estimates the sustainable yield of the Kawaihoa aquifer system at 39 MGD. Most of the past groundwater withdrawals were reportedly from the Waialua Sugar Company's irrigation wells near Kawaihoa Camp (Oki 1998). The Waialua Sugar Company ceased operating on O'ahu in 1996.

The eastern side of KTA is in the northern end of the Ko'olauloa aquifer system of the Windward hydrologic sector. Regional groundwater flow is believed to be to the north or the northeast in this part of KTA. The State of Hawai'i estimates the sustainable yield of the aquifer system at 35 MGD. Most of KTA is within the Northwest Rift Zone of the Ko'olau Volcano. The Northwest Rift Zone is densely intruded by volcanic dikes, and the groundwater system at higher elevations is dominated by dike-impounded groundwater. The Northwest Rift Zone is primarily within the Ko'olau Loa aquifer system but extends into the Kawaihoa aquifer system. The extreme northwest side of KTA marks the western boundary of the Northwest Rift Zone, where dike density decreases.

The coastal plain north and east of KTA is underlain by sedimentary deposits, including alluvial deposits and limestone caprock.

Drum Road crosses the upper portions of the Kawaihoa and Waialua aquifer systems in the north hydrologic unit and the central part of the Wahiawā aquifer system in the central hydrologic unit.

#### Groundwater Quality

Groundwater in the high-level groundwater system of the Koʻolau Mountain Range is generally of very good quality and is used as a drinking water source. On the coastal plain, groundwater has been affected by agricultural contamination. Groundwater in the Koʻolau Loa aquifer system has been affected by pesticides used in sugar cultivation, including dibromochloropropane (DBCP) and 1,2,3-trichloropropane (TCP) (HDOH 1999b). Groundwater beneath the coastal plain north of KTA has been affected by nitrates and sulfates associated with crop fertilizers and irrigation (Tenorio et Al. 1970).

### 7.8.2 Environmental Consequences

#### **Summary of Impacts**

A summary of impacts for water resources is provided in Table 7-18. Significant and mitigable impacts on surface water quality would result from the Proposed Action and RLA Alternative because Stryker off-road training would cause severe erosion on the limited terrain available at KTA. Less than significant impacts on surface water quality would result from nonpoint source chemical loading, erosion from construction activities, accidental spills on Drum Road, and flooding and erosion along Drum Road. There would also be less than significant impacts on groundwater supply from the Proposed Action and RLA Alternative.

**Table 7-18**  
**Summary of Potential Water Resources Impacts on KTA/KLOA**

Impact Issues	Proposed Action	Reduced Land Acquisition	No Action
Impacts on surface water quality	⊗	⊗	⊗
Impacts on groundwater quality	⊙	⊙	⊙
Increased flood potential or hazard	⊙	⊙	⊙
Groundwater supply	⊙	⊙	○

In cases when there would be both beneficial and adverse impacts, both are shown on this table. Mitigation measures would only apply to adverse impacts.

#### LEGEND:

⊗ = Significant	+	= Beneficial impact
⊗ = Significant but mitigable to less than significant	N/A	= Not applicable
⊙ = Less than significant		
○ = No impact		

#### **Proposed Action (Preferred Alternative)**

##### Significant Impacts Mitigable to Less than Significant

Impact 1: Surface water quality. Based on ATTACC modeling results, the Proposed Action would severely degrade land condition. MIMs are expected to increase from 7,211 under

existing conditions, to 13,772 under the Preferred Project. Under existing conditions, the effects of maneuver training on land condition are considered moderate. However, the land condition would fall to a “severe” condition under the Proposed Action. Referring to Figure 2-5, which shows the maneuverable areas available on KTA (areas with slopes less than 30 percent and unrestricted by vegetation), it can be seen that there are relatively few large contiguous areas available for maneuver training. Therefore, the effects of training would be concentrated on the limited available land and there would be little opportunity to rotate training to other areas to allow damaged lands to recover. The implication of this in the relatively steep terrain, with high annual rainfall, is that it would also significantly increase soil erosion.

Regulatory and Administrative Mitigation 1. Mitigation measures for reducing sediment loading to streams are the same as those described in Section 8.9 for mitigating soil erosion. Under the Proposed Action, USARHAW would continue to implement land restoration measures identified in the KMWP Management Plan and in the INRMP (USARHAW and 25th ID [L] 2001a). Mitigation measures would include, but not be limited to, implementation of the ITAM program to identify and inventory land condition using a GIS database; coordination between training planners and natural resource managers; implementation of land rehabilitation measures identified in the INRMP; monitoring of the effectiveness of the land rehabilitation measures; evaluation of erosion modeling data to identify areas in need of improved management; and implementation of education and outreach programs to increase user awareness of the value of good land stewardship. This mitigation would reduce this impact to less than significant.

#### Less than Significant Impacts

Surface water quality from nonpoint chemical loadings. There are no live-fire exercises using ball or tracer ammunition planned on KTA, so there would be no potential for surface water quality to be affected by residual explosives residues. However, other chemicals, such as petroleum hydrocarbons that may spill or leak onto soils as a result of vehicle use or refueling, could be bound to soil particles and then transported to surface water by erosion. These impacts are expected to be less than significant because spills would be addressed effectively through standard procedures, including training personnel in spill prevention and control techniques and requirements, maintaining appropriate spill control equipment in areas where refueling may occur, and complying with all hazardous materials management regulations.

Surface water quality from new construction sites. During ground preparation for new construction sites, grading, excavating, and trenching may expose erodible soils to stormwater runoff, with the potential for sediments to contaminate surface waters. Similarly, chemicals could spill during equipment refueling, by hydraulic lines on heavy equipment breaking, or by using chemical solvents, paints, and other chemicals in construction. These potential impacts would be reduced to less than significant levels by implementing standard construction BMPs, as required for compliance with current and future Phase 2 stormwater management regulations.

Surface water quality from potential spills on Drum Road. Accidental spills may occur and would be immediately responded to according to standard spill response procedures. Preventative

measures would include training personnel in spill avoidance and response, safe driving practices, and the proper way to transport hazardous materials in compliance with Army, state, and federal regulations. Some of the hazards of spills and accidents would be reduced compared to No Action because public roads, with their inherent risks of accidents involving civilian vehicles, would be avoided.

*Flooding and erosion of Drum Road.* Drum Road will be upgraded, including widening it, hardening the surface, installing new drainage systems, and improving stream crossings. (The environmental effects of the improvement project are evaluated in a separate document.) After construction, the assumption is that the potential for flooding would be reduced and that erosion impacts would be reduced, compared to existing conditions; however, impacts may occur due to failure of the new road with heavy use or because of unforeseen extreme natural conditions. Widening the road would likely require making additional slope cuts and fills, installing drainage conduits, and including other engineering features that would require monitoring and maintenance. Therefore, any potential impacts on surface water quality is expected to be reduced to less than significant levels through appropriate monitoring and timely implementation of repairs.

*Water supply.* KTA is located in an area with adequate water supplies. The Proposed Action is not expected to significantly increase local water demand.

### ***Reduced Land Acquisition Alternative***

The impacts associated with RLA are identical to those described for the Proposed Action.

### ***No Action***

#### *Significant Impacts Mitigable to Less than Significant*

*Impact 1: Soil erosion and surface water quality from training exercises.* Under No Action, the potential for eroding soils to affect surface water quality would continue to be potentially significant. ATTACC modeling results indicate that the current land condition has been moderately affected by training and that the current rates of soil erosion exceed the goal of long-term sustainability.

*Regulatory and Administrative Mitigation 1.* Mitigation measures would be the same as those described above for the Proposed Action.

#### *Less than Significant Impacts*

*Surface or groundwater quality from spills on public roads.* Heavy Army vehicles and slow-moving convoys using public roads can increase the potential for traffic accidents involving civilian vehicles. These accidents could result in releases of hazardous chemicals, with consequent impacts on surface water or groundwater quality. Adherence to standard Army operating procedures is expected to continue to result in a less than significant impact on water quality.

No Impacts

Groundwater supply. The groundwater issue is unchanged from the Proposed Action to the No Action alternative. The No Action Alternative is not expected to significantly increase local water demand.